Semester	IV	Course Title	Signals and Systems	Course Code	18 EC 44
Teaching Period	50 Hours	L – T – P – TL*	3 – 1 – 0 – 4	Credits	4
CIE*	40 Marks	SEE*	60 Marks	Total	100 Marks
CREDITS – 04					

Course objectives: This course will enable students to:

- Understand the mathematical description of continuous and discrete time signals and systems.
- Analyze the signals in time domain using convolution difference/differential equations.
- Classify signals into different categories based on their properties.
- Analyze Linear Time Invariant (LTI) systems in time and transform domains. Build basics for understanding of courses such as signal processing, control system and communication.

Module -1

Introduction and Classification of signals: Definition of signal and systems, communication and control systems as examples. Sampling of analog signals, Continuous time and discrete time signal, Classification of signals as even, odd, periodic and non-periodic, deterministic and non-deterministic, energy and power.

Elementary signals/Functions: Exponential, sine, impulse, step and its properties, ramp, rectangular, triangular, signum, sync functions.

Operations on signals: Amplitude scaling, addition, multiplication, differentiation, integration (Accumulator for DT), time scaling, time shifting and time folding.

Systems: Definition, Classification: linear and non-linear, time variant and invariant, causal and non-causal, static and dynamic, stable and unstable, invertible. **L1, L2, L3**

Module -2

Time domain representation of LTI System: System modeling: Input-output relation, definition of impulse response, convolution sum, convolution integral, computation of convolution integral and convolution sum using graphical method for unit step to unit step, unit step to exponential, exponential to exponential, unit step to rectangular and rectangular to rectangular only. Properties of convolution.

L1, L2, L3

Module -3

System interconnection, system properties in terms of impulse response, step response in terms of impulse response (4 Hours).

Fourier Representation of Periodic Signals: Introduction to CTFS and DTFS, definition, properties (No derivation) and basic problems (inverse Fourier series is excluded) (06 Hours). **L1, L2, L3**

Module -4

Fourier Representation of aperiodic Signals:

FT representation of aperiodic CT signals - FT, definition, FT of standard CT signals, Properties and their significance (4 Hours).

FT representation of aperiodic discrete signals-DTFT, definition, DTFT of standard discrete signals, Properties and their significance(4 Hours).

Impulse sampling and reconstruction: Sampling theorem (only statement) and reconstruction of signals (2 Hours). **L1, L2, L3**

Module -5

Z-Transforms: Introduction, the Z-transform, properties of the Region of convergence, Properties of the Z-Transform, Inversion of the Z-Transform, Transform analysis of LTI systems. **L1, L2, L3**

Course Outcomes: At the end of the course, students will be able to:

- **Acquire** knowledge the basics of Continuous time & Discrete time signals, Different Classifications of signals & system.
- **Analyse** the time domain representations for LTI systems using Convolution.
- **Apply** the concepts of Frequency domain representation of signals & its advantages.
- **Apply** the properties of Fourier representations
- **Demonstrate** the conversion of time domain signals to Z-domain.

Text Book:

- **Simon Haykins and Barry Van Veen, —**Signals and Systems‖, 2nd Edition, 2008, WileyIndia. ISBN 9971-51-239-4.

Reference Books:

- **Michael Roberts, —**Fundamentals of Signals & Systems‖, 2nd edition, Tata McGraw-Hill, 2010, ISBN 978-0-07-070221-9.
- **Alan V Oppenheim, Alan S, Willsky and A Hamid Nawab, —**Signals and Systems‖ Pearson Education Asia / PHI, 2nd edition, 1997. Indian Reprint 2002.
- **H. P Hsu, R. Ranjan, —**Signals and Systems‖, Scham's outlines, TMH, 2006.
- **B. P. Lathi, —**Linear Systems and Signals‖, Oxford University Press, 2005.
- **Ganesh Rao and Satish Tunga, —**Signals and Systems‖, Pearson/Sanguine Technical Publishers, 2004.